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Original Article

Self-efficacy profile in daily activities: Children at risk and with developmental coordination disorder

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Abstract *Aim:* The objectives of this study were: 1) to compare the perceptions of self-efficacy in the daily activities (self-care, schoolwork, and leisure) of boys and girls with DCD, or in children at risk for DCD (r-DCD) and in typical children (TD); 2) to investigate if a self-efficacy assessment could be a support tool in the establishment of children with the DCD profile.
Methods: Children between 6 to 8 years old (N=115: 35 with DCD, 40 with r-DCD, 40 with TD) were assessed using the Movement Assessment Battery for Children (MABC-2) and the Perceived Efficacy and Goal Setting System (PEGS). A two-way MANOVA showed significant effect for the perceived self-efficacy group.
Results: The Bonferroni post hoc test indicated that in the self-care, schoolwork, leisure, and general self-efficacy dimensions the children with DCD presented significantly lower scores compared to children with r-DCD and TD ($p < 0.001$). A similar result was observed for r-DCD children in comparison with TD ($p < 0.001$). The discriminate analysis showed that perceived self-efficacy in leisure activities was the variable that most contributed to the discrimination of the groups.
Conclusion: The judgment of children with DCD and r-DCD on the effectiveness of the execution of schoolwork and leisure activities may have been influenced by the motor skill difficulties showed by the children.

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1. Introduction

Children with developmental coordination disorder (DCD) present difficulties on the fulfilment of daily motor tasks such as tying a shoelace, closing a jacket button, and putting on a t-shirt.[1–3] Difficulties may also be observed as the child attempts to perform motor tasks such as jumping over an obstacle, and throwing or kicking a ball.[4,5] The low motor proficiency is not related to neurological pathologies or severe intellectual disadvantages.[6] However, it has an undesirable influence on social interactions,[6,7] restricting the child from experiences that are essential to child development.

These motor difficulties in performing the daily tasks observed in children with DCD may also cause a negative impact in their perceptions of self-efficacy.[8,9] This important psychological construct refers to the judgment that the individuals make about their own capabilities of mobilizing cognitive resources and control events during the performance of various activities.[10,11] During childhood, self-efficacy is particularly important since it is associated with the motivation for the achievement of goals and learning[12]; and the persistence in face of difficulties.[10] Children with feelings of low self-efficacy dispense little effort in face of obstacles and adversities, assume defensive behaviours and minimal commitment, and tend to search for easier activities.[13] Self-efficacy has remained a construct that lacks investigation for children with DCD, although the claim for this need has been presented over the past decade.[8,14,15] Considering that these children experience difficulties in the accomplishment of tasks concerning which children without motor disorders have little or no difficulties whatsoever,[16] low self-efficacy may be harder for children with DCD.

Studies have reported that, compared to children with typical development, children with DCD show negative judgment about their own capabilities in organized physical activities and recreational games.[14,16] However, few studies have analysed the perceived self-efficacy in activities such as self-care,[13] schoolwork, and leisure[8,9,14,15] of children with DCD.[8,9,14,15] It seems that a constant experience of difficulty in daily activities could affect the judgments of a child about their own capabilities; therefore, the use of an assessment related to this construct could help to discriminate the characteristics of these groups of children. Furthermore, although it seems that boys and girls with DCD have similar self-judgment about motor skills,[16] evidence is still necessary to understand this phenomenon further.

Considering that the construction of a positive sense about one's own efficacy is an important aspect in child development, the aims of this study were: 1) to compare the perceptions of self-efficacy in the daily activities (self-care, schoolwork, and leisure) of boys and girls with DCD, r-DCD and TD; and 2) to investigate whether self-efficacy assessment could be a support tool in establishing the children with DCD profile.

2. Methods

2.1. Participants

Initially, 420 children of both sexes, of 6—8 years old (7.1 ± 0.74), from three municipal public schools from south Brazil were assessed using the Movement Assessment Battery for Children-Second Edition - MABC-2 17. Children lived in neighbourhoods located in central urban zones, of a large city, for low-income families 9family income was maximum of two minimums Brazilian' wages). Children without neurological disorders or physical limitations were included in the study. Parents, teachers and/or health assistants from the schools provided children's health information. The cut-off points recognized in the literature were adopted in the present study (DCD: score at or below the 5th percentile; r-DCD: scores between the 6th and 15th percentile; TD: scores at or above 16th percentile). Among the 420 children assessed, 35 (8.3%) were categorized as DCD, 58 (13.8) with risk and 327 (77.9%) with TD.[17] Paired groups were established considering sex and age. Therefore, in total 115 children were included in the second part of the study: 35 children with DCD (boys = 16; girls = 19), 40 children with r-DCD (boys = 19; girls = 21), and 40 children with TD (boys = 20; girls = 20). Teachers from the children's schools provided school performance reports. All children with DCD were described by their teachers as having learning difficulties and low school performance, which was confirmed by parents.

2.2. Instruments

The MACB-2 17, validated for Brazilian children[18] was used in the present study. The Brazilian version presents high rates of content validity with clarity and relevance (Kappa: 71.8 to 99.9); and it elevates reliability (inter-raters: ICC 0.86 a 0.99; intra-rater: ICC 0.68 to 0.85), temporal stability ($r = 0.52$ to 0.74, $p < 0.001$), internal consistency ($\alpha = 0.78$ to 0.52), and discriminant capacity.[18] The MACB-2 is composed of eight motor tests that assess manual dexterity, aiming, catching and balance, organized in three age groups (Age Band 1 to 3 to 6 years-old; Age Band 2 to 7 to 10 years-old; Age Band 3: over 11 years-old). This study was conducted with children from age band 2.

To assesses the children's self-efficacy, the Perceived Efficacy and Goal Setting System — PEGS,[19] translated to Brazilian Portuguese and validated for Brazilian children, was used.[20] The Brazilian version presents adequate rates of internal consistency (children's protocol $\alpha = 0.81$; teachers questionnaire: $\alpha = 0.88$; caretakers questionnaire: $\alpha = 0.70$) and reliability (weighted Kappa: 58 a 83%). [20] The PEGS is composed by a child and caretakers' assessment. For the child's assessment, 27 pairs of test

cards containing illustrations of children in self-care, schoolwork, and leisure activities where used. The card illustrates children performing the activities easily, meaning more skill, and with more difficulty, meaning less skill. Test administrators read the description of the activity contained on the card and ask the child to choose the card that is more similar to him or to her. Afterwards the child indicates if the condition chosen is "very" or "a little" like him or to her. The questionnaires for the caretakers and teachers contain the same items that are presented to the children. These identify if the evaluated child has any difficulty in performing any of the activities. In this study, only the protocol for the children was used.

2.3. Procedures

This study was approved by the university ethics committee (protocol n. 242/2010). The municipal education board was contacted and provided institutional consent for the implementation of the research. The administrators of the schools, approved by the board of education, also provided school consent to participate in the study. Two schools were selected using the following criteria: 1) children from 7 to 8 years old are enrolled in the school; 2) schools are located in an urban area of the city; and 3) There is access to rooms with physical space suitable for the conduction of the motor tests (rooms with ample space) and for the implementation of the perceived self-efficacy tests (individual rooms). Teachers, parents and/or persons responsible for the children were contacted to explain the procedures adopted in informed consent for participation in the study.

Trained evaluators, with at least two years of experience using the MABC-2, individually assessed children. The duration of each assessment was approximately 20 min. Two other evaluators conducted the evaluation of perceived self-efficacy independently. PEGS was applied individually at specific times established by the teachers. The cards were presented to the children as were descriptions of the activities embodied in the cards illustrated. The children were oriented to choose a condition they judged was most close to them. After the choice, the children indicated if the condition chosen was very close or a little close to them. The duration of the test was approximately 15 min. In this study the sum of the points of the items of each dimension evaluated (self-care, schoolwork, leisure) and the total sum of the items (total self-efficacy) were considered. For the classification of self-efficacy in the dimensions evaluated, the values of the sum of the items were transformed in to standard "z" scores. "Z" values ranging from -1 to $+1$ were considered as moderate self-efficacy. Values smaller than -1 were considered low self-efficacy, and values higher than $+1$ were considered high self-efficacy.

2.4. Statistical analysis

Means of average, standard deviation, frequency and percentage are provided. The normality was assessed by uni and multivariate coefficients of asymmetry (sk) and kurtosis (ku), considering values larger than 3 for sk and larger than 7 for ku as severe violation to the normal distribution. The existence of multivariate *outliers* was assessed by Mahalanobis's squared distance (D^2), and, when detected, these where eliminated.[21] A multivariate analysis of variance (MANOVA) *two way* was used to verify possible effects of the DCD, r-DCD and TD, and gender (male and female) (independent variables) about the dimensions of self-efficacy investigated (self-care; schoolwork, motor activities and leisure) and in the total auto-efficacy (dependent variables). The Maximum Likelihood criteria (Wilks' lambda) was adopted. Bonferroni's test of multiple comparisons was employed to verify possible differences when main effects or interaction results were identified. Partial eta (η^2) was provided as measure of effect size. A multiple discriminate analysis was used to verify the perceived self-efficacy' dimensions that better discriminated children with DCD, r-DCD and TD, adopting as a parameter Wilks's test.[22] The significance level adopted was $\alpha \leq 05$.

3. Results

Most children with DCD reported moderate to low self-efficacy in all dimensions. No children with DCD reported high levels of perceived self-efficacy. Children with DCD perceived themselves with low self-efficacy in the leisure (68.4% girls and 87% boys) and global self-efficacy dimension (63.2% girls and 81.3% boys). Children at r-DCD reported moderate self-efficacy, whereas children with TD reported moderate to high self-efficacy in all dimensions (see Table 1).

Table 1 Provides the categorization of perceived self-efficacy by groups and sex.

Fig. 1 shows the boys' and girls' means and standard deviations for the perceived self-efficacy' dimensions and global self-efficacy. The multivariate variance analysis showed significant groups main effect (DCD, r-DCD and TD) for perceived self-efficacy ($\Lambda = .09$, F (6, 214) = 84.74, $p < .001$, $\eta^2 = .70$). Significant differences between the groups were observed for the perceived self-care (F (2, 115) = 139.33, $p < .001$, $\eta^2 = .72$), schoolwork (F (2, 115) = 138.94, $p < .001$, $\eta^2 = .72$), leisure activities (F (2, 115) = 241.59, $p < .001$, $\eta^2 = .82$), and also global self-efficacy (F (2, 115) = 239.82, $p < .001$, $\eta^2 = .81$). Bonferroni's multiple comparison test showed that children with DCD presented significantly lower perceived self-efficacy (with high effect sizes) compared to children with r-DCD in the self-care dimension (DCD: M = 7.20, SD = 2.10; r-DCD: M = 9.80, SD = 3.30; $p < .001$), schoolwork dimension (DCD: M = 14.60, SD = 4.30; r-DCD M = 19.60, SD = 4.20; $p < .001$), leisure activities dimension (DCD: M = 16.60, SD = 3.60; r-DCD: M = 30.30, SD = 4.40: $p < .001$), and global self-efficacy (DCD: M = 38.40, SD = 7.80; r-DCD: M = 59.80, SD = 9.30; $p < .001$).

In addition, DCD group also showed lower self-efficacy in relation to the TD group in self-care (DCD: M = 7.20, SD = 2.10; TD: M = 17.00, SD = 2.50; $p < .001$) in schoolwork (DCD: M = 14.60, SD = 4.30; TD: M = 31.30, SD = 5.30; $p < .001$), leisure activities (DCD: M = 16.60, SD = 3.60; r-DCD: M = 36.20, SD = 3.50; $p < .001$), and

Table 1 Frequency and percentage of categorization of perceived self-efficacy of the total children and accordingly to gender and groups.

PEGS Dimensions & Global	Categorization of perceived self-efficacy N (%)								
	DCD			r-DCD			TD		
	Low	Mod	High	Low	Mod	High	Low	Mod	High
Girls									
Self-care	8 (42.1)	11 (57.9)	—	3 (14.3)	17 (81.0)	1 (4.8)	—	10 (50.0)	10 (50.0)
Schoolwork	7 (36.8)	12 (63.2)	—	—	21 (100)	—	—	8 (40.0)	12 (60.0)
Leisure	13 (68.4)	6 (31.6)	—	—	21 (100)	—	—	13 (65.0)	7 (35.0)
Global	12 (63.2)	7 (36.8)	—	—	20 (95.2)	1 (4.8)	—	7 (35.0)	13 (65.0)
Boys									
Self-care	7 (43.8)	9 (56.3)	—	3 (15.8)	16 (84.2)	—	—	8 (20.0)	12 (80.0)
Schoolwork	4 (25.0)	12 (75.0)	—	1 (5.3)	18 (94.7)	—	—	5 (25.0)	15 (75.0)
Leisure	14 (87.5)	2 (12.5)	—	2 (10.5)	17 (89.5)	—	—	10 (50.0)	10 (50.0)
Global	13 (81.3)	3 (18.8)	—	2 (10.5)	17 (89.5)	—	—	9 (45.0)	11 (55.0)
Total									
Self-care	15 (42.9)	20 (57.1)	—	6 (15)	33 (82.5)	1 (2.5)	—	18 (45)	22 (55)
Schoolwork	11 (31.4)	24 (68.6)	—	1 (2.5)	39 (97.5)	—	—	13 (32.5)	27 (67.5)
Leisure	27 (77.1)	8 (22.9)	—	2 (5)	38 (95)	—	—	23 (57.5)	17 (42.5)
Global	25 (71.4)	10 (28.6)	—	2 (5)	37 (92.5)	1 (2.5)	—	16 (40)	34 (60)

global self-efficacy (DCD: M = 38.40, SD = 7.80: TD: M = 84.60, SD = 9.60; $p < .001$). Bonferroni's test revealed that the r-DCD group presented significantly lower perceived self-efficacy when compared to the TD group regarding self-care (r-DCD: M = 17.00, SD = 2.50; TD: M = 9.80, SD = 11.00; $p < .001$), schoolwork (r-DCD: M = 31.30, SD = 5.30; TD: M = 11.00, SD = 11.00; $p < .001$), leisure activities (r-DCD: M = 16.60, SD = 3.60; TD: M = 30.30, SD = 4.40; $p < .001$), and global self-efficacy (r-DCD: M = 84.60, SD = 9.60; TD: M = 59.80, SD = 9.30; $p < .001$).

The discriminate multivariate analysis indicated that the function with the perceived self-efficacy variables of self-care (value of the structure matrix = .660), schoolwork (value of the structure matrix = .638) and leisure activities (value of the structure matrix = .936) was capable of significantly discriminating (Wilks' $\Lambda = .91$, $\chi^{26} = 266.01$, $p < .001$) children with DCD, r-DCD and TD (Z

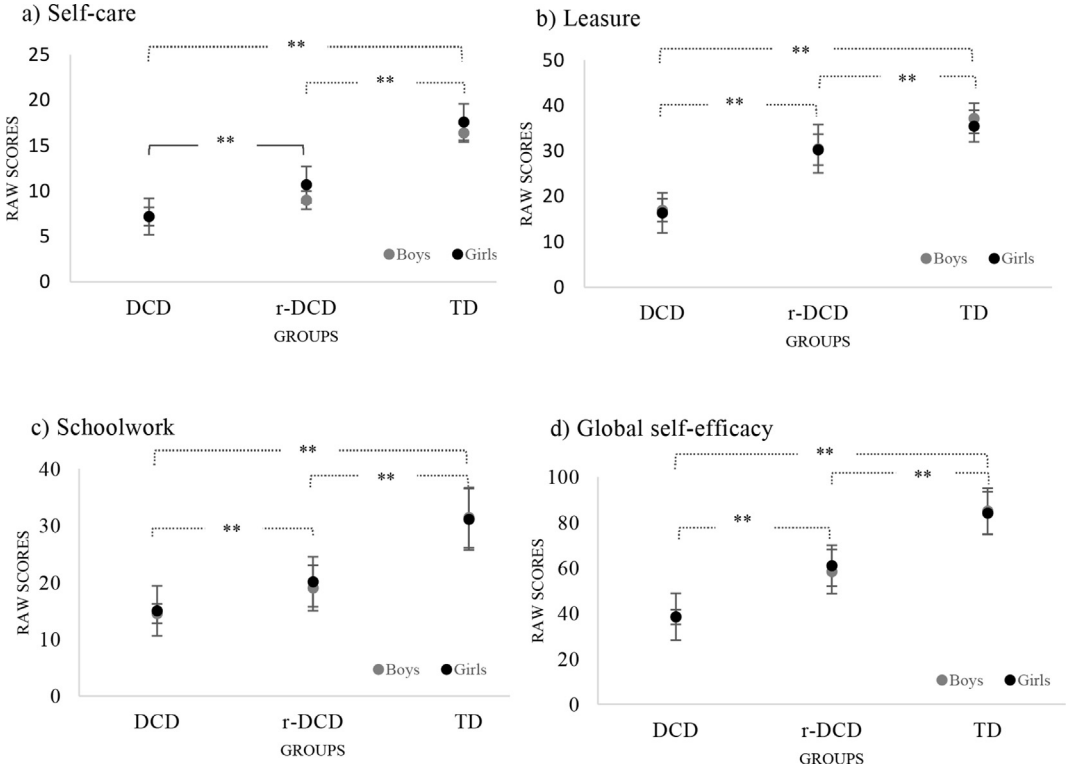

Figure 1 Perceived self-efficacy in self-care (a), leisure (b), schoolwork (c), and global self-efficacy (d) scores by groups.

equation = −8.04 + .127* PEGS item sum self-care + .017* PEGS item sum schoolwork + .197* PEGS item sum leisure activities). The self-efficacy in leisure activities was the variable that most contributed to group discrimination. In Fig. 2 the mean dispersion (centroid) and the discriminant Z scores of the three groups are observable.

The discriminant model highlighted that 94.3% of the DCD group, 85% of the r-DCD group, and 87.5% of the TD group were classified correctly (see Table 2).

Table 2 Success rate for the prediction of group members for variables groups by discriminant function.

Classification		Group Members Prediction		
DCD	rDCD	TD		
%	DCD	94,3	5,7	—
%	rDCD	7,5	85,0	7,5
	TD	—	12,5	87,5
%	MABC	88.7% of original cases correctly classified		

4. Discussion

The objective of this study was to compare the perceived self-efficacy in activities such as self-care, schoolwork, and leisure of boys and girls with DCD, r-DCD, and with typical development (TD) and also to investigate whether self-efficacy assessment could be a support tool in establishing children with a DCD profile. In both sexes, children with DCD showed lower self-efficacy, above all in the leisure activities dimension and global self-efficacy. The majority of boys and girls at r-DCD reported moderate levels of self-efficacy in the three dimensions and in global self-efficacy. The group of children with TD, regardless of gender, showed moderate to high levels of self-efficacy in the dimensions and global indexes.

The multivariate analysis revealed significant group effect on the perceived self-efficacy. Children with DCD presented a lower level of self-efficacy when compared to children with r-DCD and TD. Furthermore, children with r-DCD also presented lower levels of self-efficacy compared to children with TD. Aligned with these results, previous studies conducted with Israeli children, between the ages of 5—9 years,[13] and Canadian children, between the ages of 5 to 8[14,16] also reported significantly lower scores of perceived self-efficacy in self-care, schoolwork, and leisure activities for children with DCD when compared to children with typical development (TD).

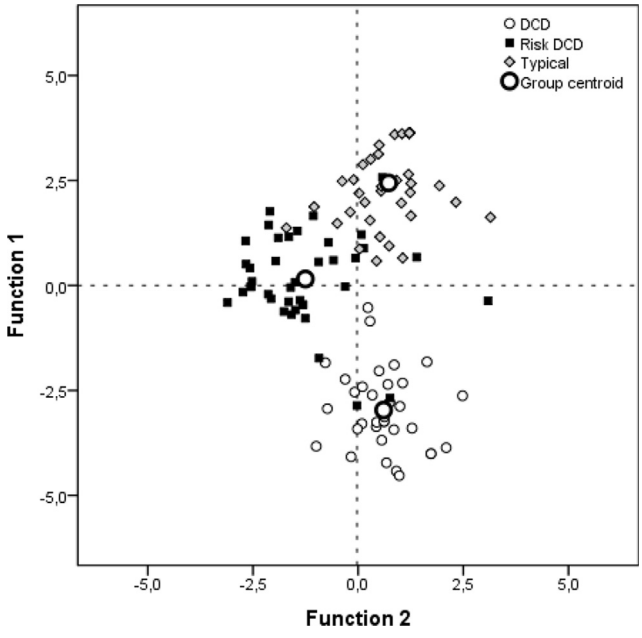

Figure 2 Discriminant Z scores dispersion and group centroids for children with DCD, at r-DCD and DT.

Boys and girls with DCD in the present stud, are conscious of their motor difficulties and expressed these perceptions, as evidenced by the low scores of self-efficacy. The low sense of self-efficacy observed in the present study probably emerged from the difficulties that these children face while performing daily activities.[13,16] Students beliefs in their efficacy to regulate their own learning and to master academic activities determine their aspirations, level of motivation, and academic accomplishments.[23] In this way, it could contribute to their lower sense of self-efficacy.

Motor activities are a part of daily leisure activities during childhood. However, children with DCD spend more time alone as spectators and are excluded from these activities because of their low motor capabilities, affecting their perceptions. The motor activities seem to demand, for children with DCD, more attention in the execution of these tasks, reducing, in this way, the possibility for these children to participate in social arrangements and increasing the probability of perceiving themselves as ineffective and thus isolating themselves.[13,24] Therefore, these children have restricted opportunities to develop social interactions that are constructed in motor games.

In the present study, children with DCD demonstrated low perceptions of self-efficacy in the schoolwork dimensions. Research shows a relation between developmental coordination disorder and executive functions related to school performance, such as working memory[12,25,26] inhibitory control[26,27] and cognitive flexibility.[26] Although this construct was not measured in the present study, it is possible to infer that the deficit of these functions could have a negative repercussion in the schoolwork sense of self-efficacy of these children. Similar results were recently reported for school age children.[28] Yet the lack of confidence has been reported as one of the main causes for a lower level of participation of children with DCD in physical activities.[29] This might also affect the children in the present study as the motor difficulties became more evident.

Although in the present study, children with r-DCD report, movement difficulties (percentile 6 to 15 in MABC-2), they expressed moderate levels of perceived self-efficacy in the dimensions investigated. The self-efficacy of these children has probably not yet been affected by motor difficulties and/or these children lack more precise parameters to compare their difficulties since they showed less notice motor limitations when compared with children with DCD.[30] Is time, these children may become more vulnerable to social comparisons and present further declines in the self-efficacy perceptions.

Further studies should focus also on the at risk children to prevent the negative self-efficacy perceptions detected in the group of children with DCD.

In the present study, there were no gender interaction effects between the groups of children on the three dimensions of perceived self-efficacy and global self-efficacy. This result was similar to previous studies.[13,16] The results presented in this study revealed that the impact of coordination disorders on perceived self-efficacy may have similar effects on boys and girls.

The discriminant analysis showed that perceived self-efficacy in leisure activities was the variable that most contributed for discrimination between the groups. This meaning that the successive experience of failure and low sense of control,[10] mainly in activities such as riding a bicycle, playing with ball games, playing with classmates, and running, may strongly affect the perceptions of DCD and, in this way, distinguish DCD children from TD. In a similar way, this may happen with r-DCD in comparison to TD. These results suggest that the self-efficacy measurement can assist researchers and physicians in understanding the repercussions that the disorder has on the life of a child. Understanding the self-efficacy profile of DCD children may also help researchers and practitioners in the planning of adequate intervention strategies to prevent the weakening of these children's self-concept.

A positive and realistic construction of self-efficacy depends on the challenges and the environmental conditions that demand functional adaptations and self-renewal inside the situations/problems that the person faces, and the mediator agents fulfill a fundamental role in this process 10. Interventions, especially implemented in the beginning of the occurrence of the disorder, are recommended since these motor problems tend to persist throughout puberty and adult life.[7,12,31,32]

5. Limitations

Although the results revealed two distinct cognitive profiles for the DCD, limitations within this study need to be acknowledged. The criteria excluded children with attention deficit hyperactivity disorder (ADHD) or children with autism spectrum disorder (ASD) symptoms was Questionnaires were answered by classroom teachers based on the children school' profile and family's medical information. However, a physician and/or psychiatrist did not screen children during the implementation of the e present study, due to financial limitations. It is possible, therefore, that some children who participate in the present study had co-occurrence of DCD and ADHD or ASD, although families and teachers provided no information with regard to this matter, which may partially affect the results.

6. Conclusion

This study advances the current knowledge by providing evidence that the judgment that children with DCD and r-DCD perceived and expressed about their own capabilities in daily activities suffer under the influence of their own motor limitations independently of sex. Furthermore, measuring self-efficacy in children with DCD and r-DCD may provide support to caregivers, teachers, psychologists, and other professionals in their evaluation and interventions and, consequently, promote health and well-being for these children. It is possible to assume that in the long term the low sense of self-efficacy could impact the confidence of these children to attempt to master new tasks. The participation in organized motor activities as well as characteristics of contexts in which they are actively inserted were not investigated and are assumed to the limitations of the present study.

Declarations of interest

The authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedneo.2019.03.012.